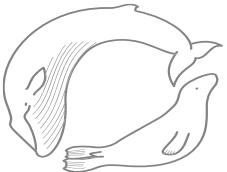
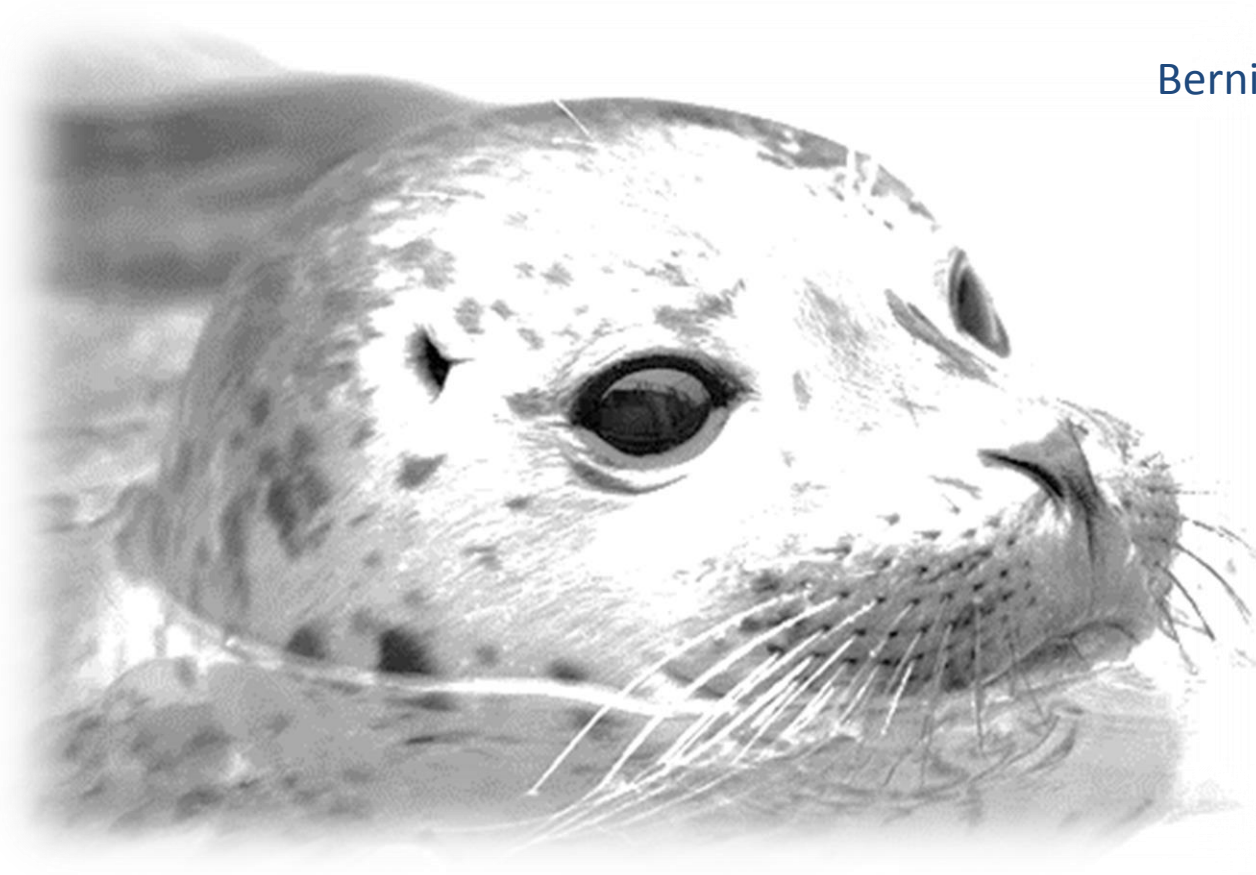


IoT and the internet of the sea

Bernie McConnell



University of
St Andrews



Sea Mammal
Research
Unit

Harbour seal decline

50, 000 UK population

70% decline in E and N Scotland in last 10 years !

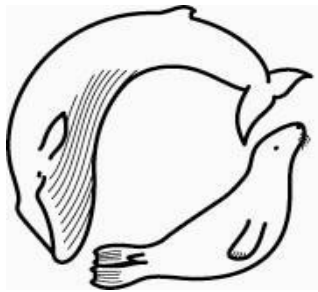


What is the cause?

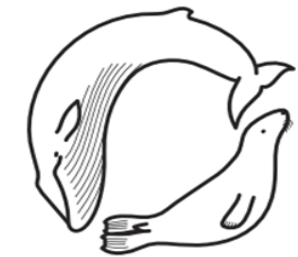
What can be done?

Can the IoT assist?

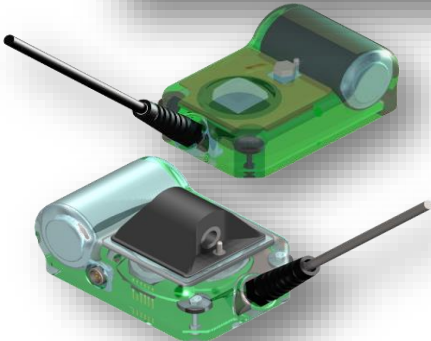




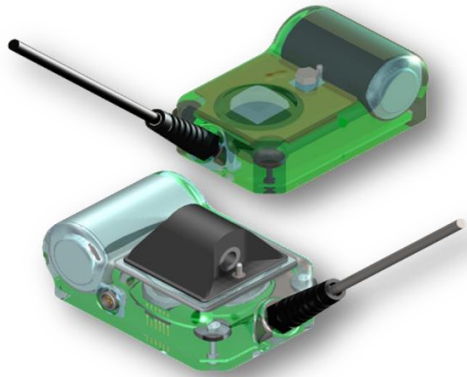
Sea Mammal Research Unit



Sea Mammal Research Unit Instrumentation



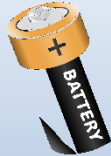
Anatomy of a SMRU-IG tag



sensors
on-board processing
data relay (c. 5 Kbytes day⁻¹)
attachment

design constraints

energy



opportunity



Sensors

location

pressure

acceleration / attitude -> behaviour, feeding, condition, fine-scale movement

sound

conductivity / salinity temperature

fish tag identification

...

Marine mammal fit bits
Wearable tech

Seals extend the sensory reach of the IoT

seawards and underwater



Satellite (Iridium, Argos, ...)

NB-IoT coverage + 20dB

3G M2M coverage



0 m

100 m

6 months at sea

5 days



Coverage extension

ad hoc network extension



peer2peer data
sharing



Harbour seal decline study :: tagging

© Mònica Arso - SMRU



March 2016: 10 harbour seals tagged for three months until breeding/moult





Data SIO, NOAA, U.S. Navy, NGA, GEBCO

Image Landsat

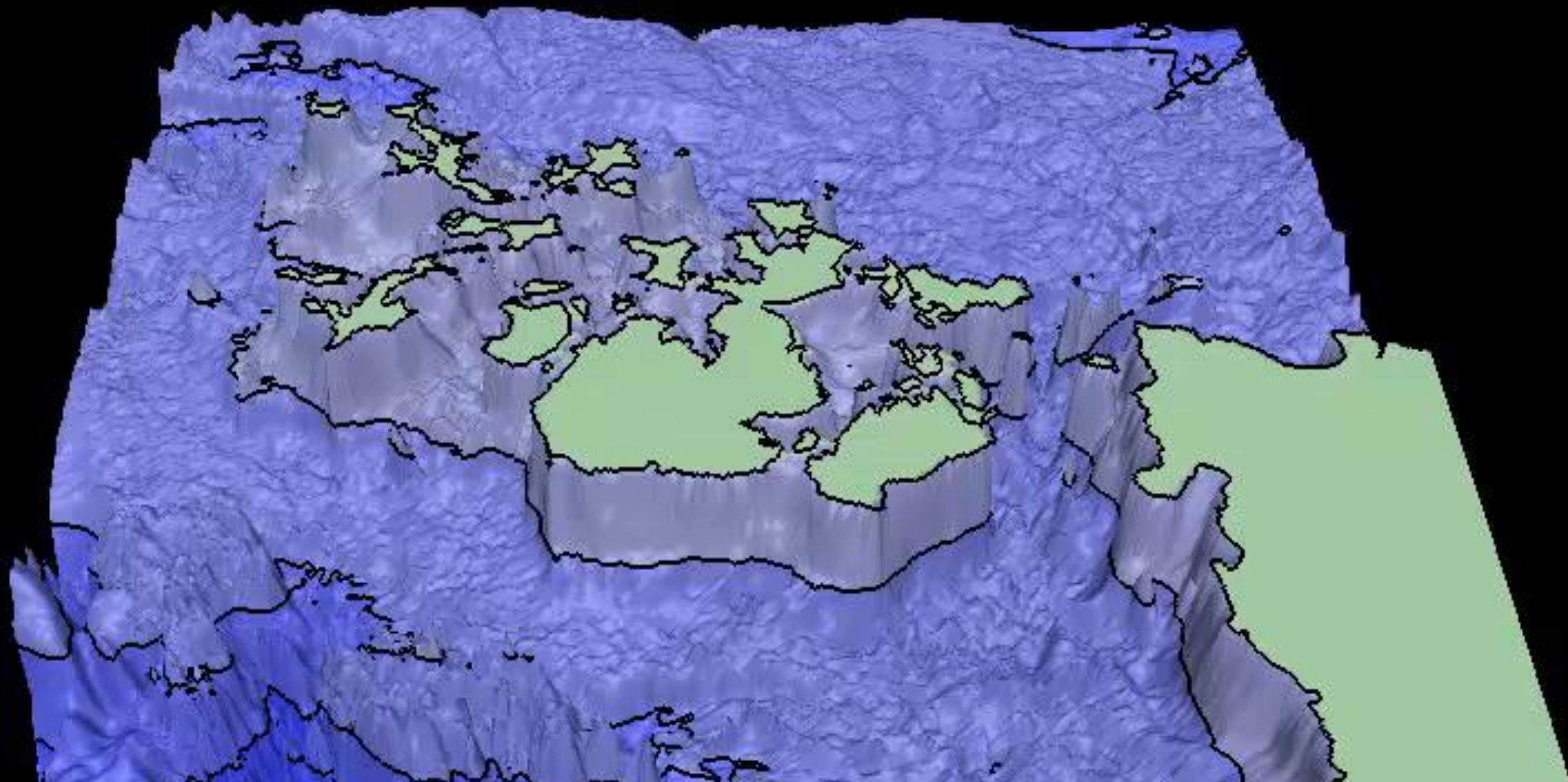
Google earth

2016-04-11 13:00:00Z

Tail 1 day

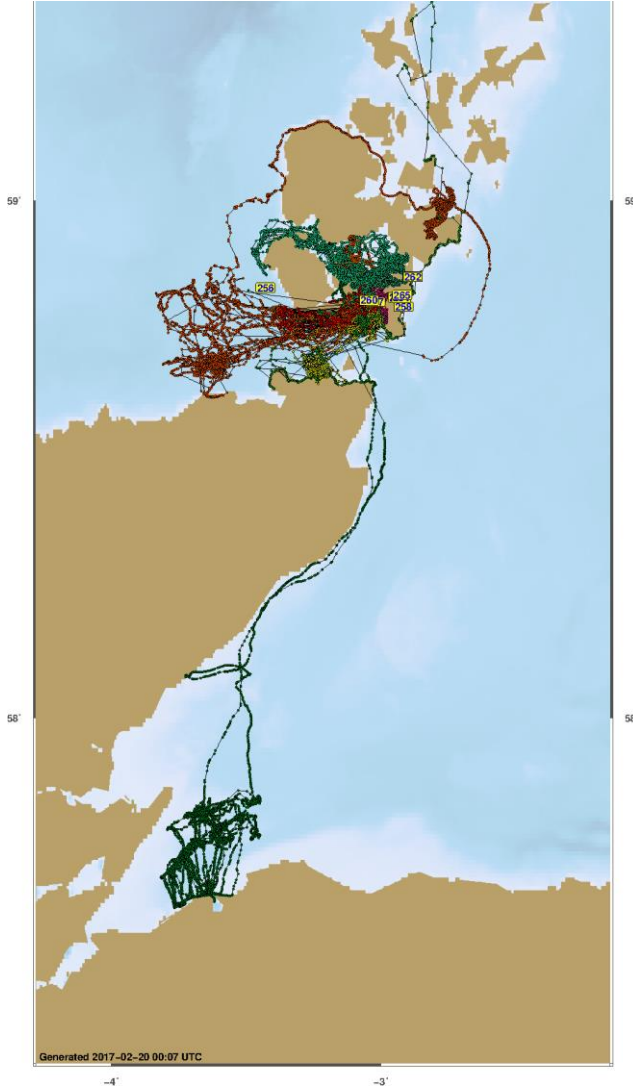


Sea Mammal
Research Unit
Instrumentation



Harbour seal decline

what have we learned from M2M tags so far



- Identified at feeding area. Targeted for extensive study
- Followed individuals to their July breeding sites
- Quantified their geographical movement

Future of long term study:

- More tagging in other areas with contrasting population trends
- Smaller NB-IoT tags



the IoT, an ecologist's perspective

- low-energy sensors and comms
- determine behaviour
- determine population behaviour
- determine processes that drive behaviour
- predictive models

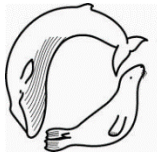


Internet of the sea - vision





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St Andrews



**Sea Mammal
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Unit**



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Instrumentation**



Universities
Regulators
Outreach
Conservation
Telecoms Industry

Statistical modelling
Sensor development
Low-energy systems
Autonomous systems
Material science
Satellite comms

2018 Decade of Bio-Logging

Marine Bio-Telemetry Centre

